

CLAIMS

1. A prepolymer as a reaction product between a compound A and a compound B, the compound A and the compound B each having two or more functional groups or sets of functional groups in one molecule, and the compound A and the compound B being capable of undergoing polymerization as a result of binding of the functional groups or sets of functional groups of one compound with the functional groups or sets of functional groups of the other compound to thereby form a high-molecular-weight polymer with a porous structure.

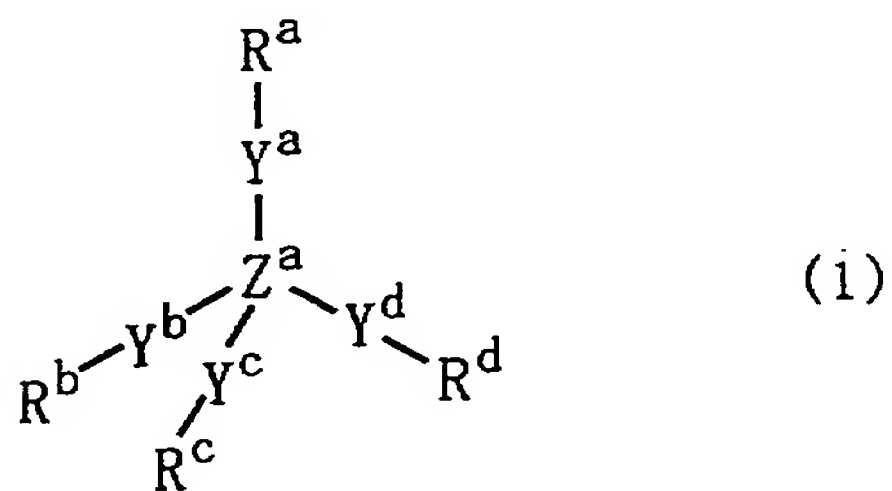
2. The prepolymer according to claim 1, which has a weight-average molecular weight of 200 to 100000.

3. The prepolymer according to one of claims 1 and 2, as a reaction product of a compound A and a compound B, the compound A and the compound B being capable of forming a high-molecular-weight polymer with a porous structure as a result of a polymerization process, the polymerization process comprising a first reaction process of allowing the functional groups or sets of functional groups of one compound to react with the functional groups or sets of functional groups of the other compound to form a chain bond; and a second reaction process of forming a ring at the binding site, wherein the prepolymer is a reaction product of the first reaction process.

4. The prepolymer according to claim 3, wherein the chain bond formed in the first reaction process is one of an amide bond, an ester bond, and a thioester bond, and the ring which will be formed in the second reaction process is one of an imidazole ring, an oxazole ring, a thiazole ring, and an imide ring, in the reaction between the functional groups or sets of functional groups of the compound A and the functional groups or sets of functional groups of the compound B.

5. The prepolymer according to claim 4, wherein the functional groups or sets of functional groups of the compound A are each a carboxyl group or an amino group, and wherein the functional groups or sets of functional groups of the compound B are two amino groups; an amino group and a hydroxyl group; an amino group and a mercapto group; or two carboxyl groups.

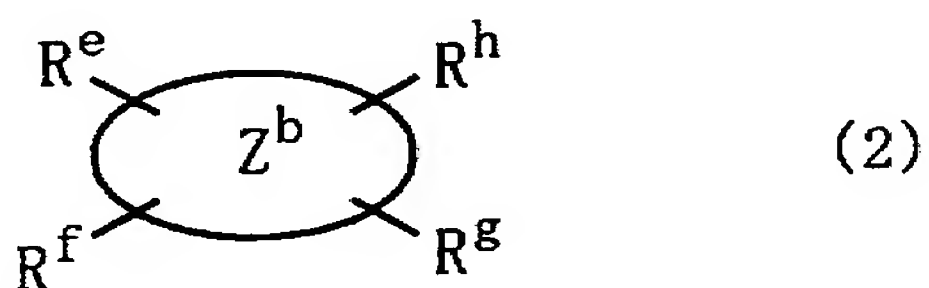
6. The prepolymer according to any one of claims 1 to 5, wherein the compound A is a compound represented by following Formula (1):



wherein Z^a represents a quadrivalent organic group; R^a , R^b ,

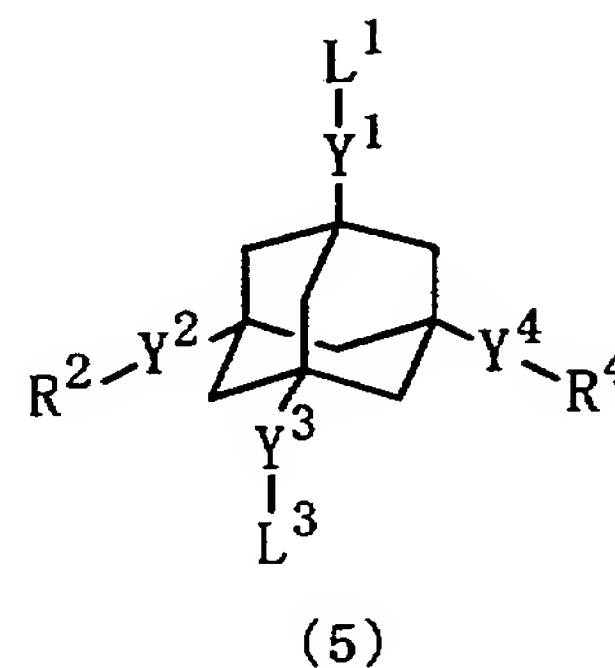
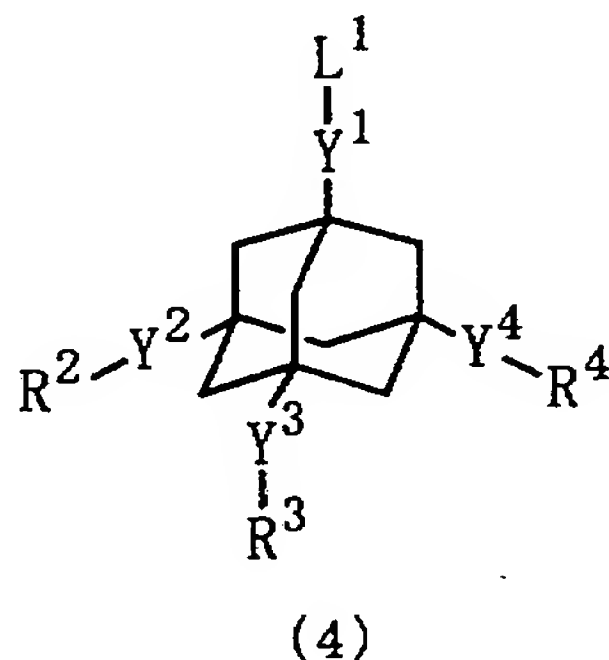
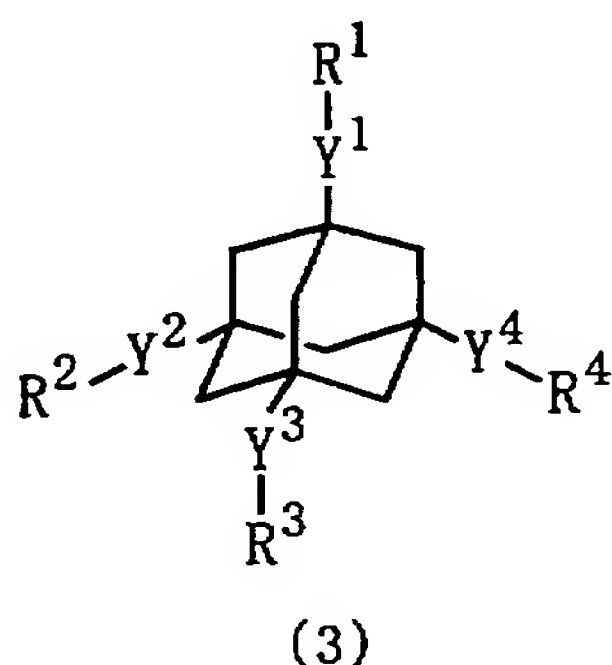
R^c , and R^d are the same as or different from one another and each represent a protected or unprotected carboxyl group, a haloformyl group, a protected or unprotected amino group, a protected or unprotected hydroxyl group, a protected or unprotected mercapto group, a hydrogen atom, or a hydrocarbon group; and Y^a , Y^b , Y^c , and Y^d are the same as or different from one another and each represent a single bond or a bivalent aromatic or nonaromatic cyclic group, wherein at least two of R^a , R^b , R^c , and R^d each represent a protected carboxyl group, a haloformyl group, a protected or unprotected amino group, a protected or unprotected hydroxyl group, or a protected or unprotected mercapto group.

7. The prepolymer according to any one of claims 1 to 5, wherein the compound B is a compound represented by following Formula (2):

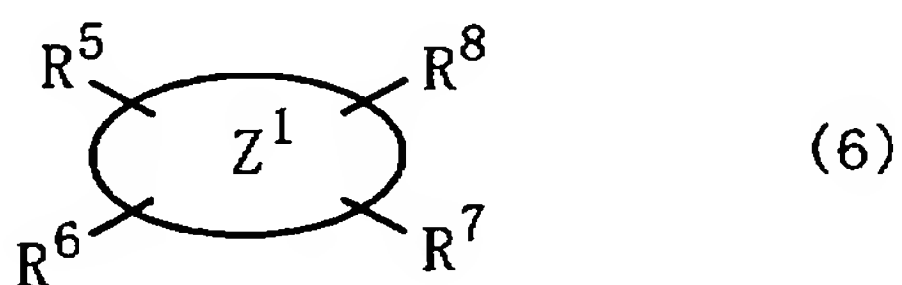


wherein Ring Z^b represents a monocyclic or polycyclic aromatic or nonaromatic ring; and R^e , R^f , R^g , and R^h are substituents bound to Ring Z^b , are the same as or different from one another, and each represent a protected or unprotected amino group, a protected or unprotected hydroxyl group, a protected or unprotected mercapto group, or a protected or unprotected carboxyl group.

8. The prepolymer according to any one of claims 1 to 3, which is a reaction product between at least one adamantanepolycarboxylic acid derivative represented by following Formula (3), (4), or (5):



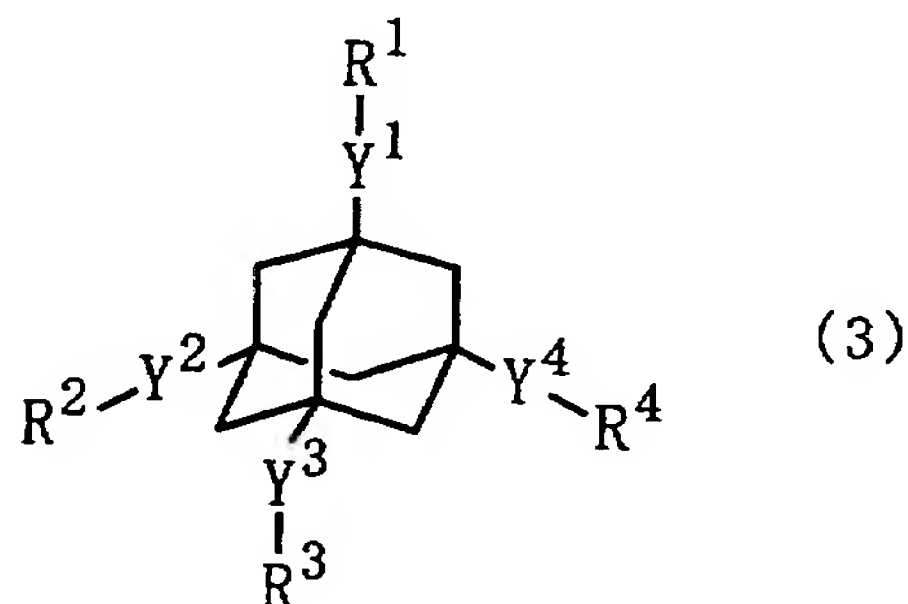
wherein R^1 , R^2 , R^3 , and R^4 are the same as or different from one another and each represent a protected or unprotected carboxyl group or a haloformyl group; Y^1 , Y^2 , Y^3 , and Y^4 are the same as or different from one another and each represent a single bond or a bivalent aromatic or nonaromatic cyclic group; and L^1 and L^3 are the same as or different from each other and each represent a hydrogen atom, a protected or unprotected carboxyl group, or a hydrocarbon group, and a polyamine derivative represented by following Formula (6):



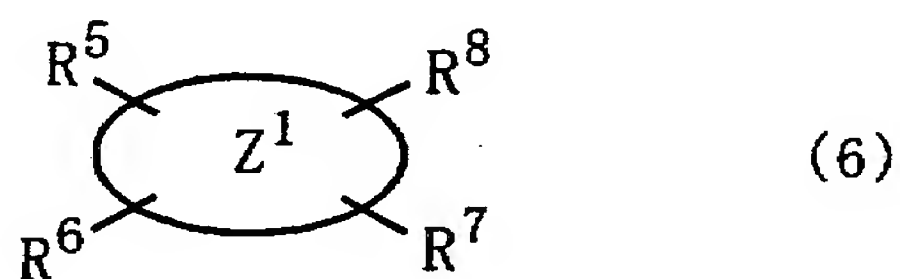
wherein Ring Z^1 represents a monocyclic or polycyclic

aromatic or nonaromatic ring; and R^5 , R^6 , R^7 , and R^8 are substituents bound to Ring Z^1 , are the same as or different from one another, and each represent a protected or unprotected amino group, a protected or unprotected hydroxyl group, or a protected or unprotected mercapto group, wherein at least two of R^5 , R^6 , R^7 , and R^8 are each a protected or unprotected amino group, wherein the prepolymer comprises an amide bond, an ester bond, or a thioester bond formed as a result of a reaction of the protected or unprotected carboxyl group or haloformyl group in R^1 , R^2 , R^3 , and R^4 of the adamantanepolycarboxylic acid derivative represented by Formula (3), (4), or (5) with the protected or unprotected amino group, protected or unprotected hydroxyl group, or protected or unprotected mercapto group in R^5 , R^6 , R^7 , and R^8 of the polyamine derivative represented by Formula (6).

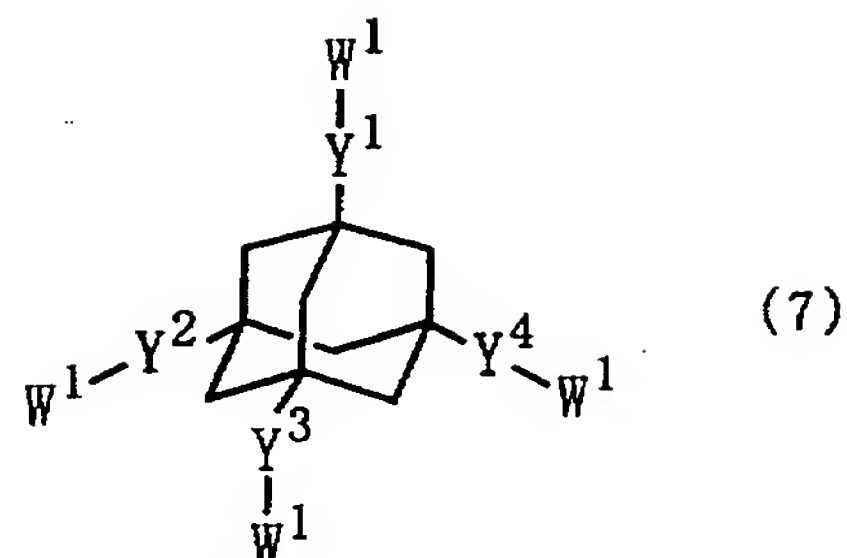
9. The prepolymer according to claim 8, as a reaction product between an adamantanepolycarboxylic acid derivative represented by following Formula (3):



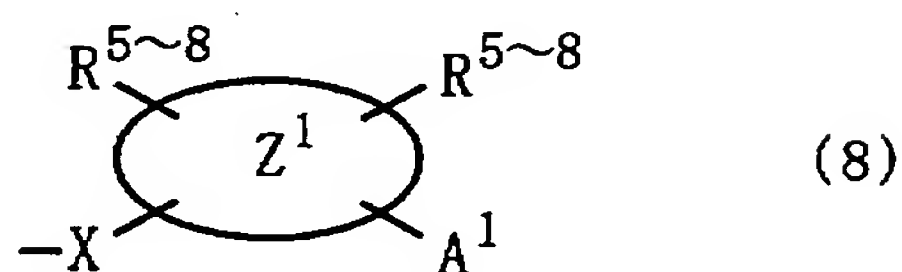
wherein R^1 , R^2 , R^3 , and R^4 are the same as or different from one another and each represent a protected or unprotected carboxyl group or a haloformyl group; and Y^1 , Y^2 , Y^3 , and Y^4 are the same as or different from one another and each represent a single bond or a bivalent aromatic or nonaromatic cyclic group, and a polyamine derivative represented by following Formula (6):



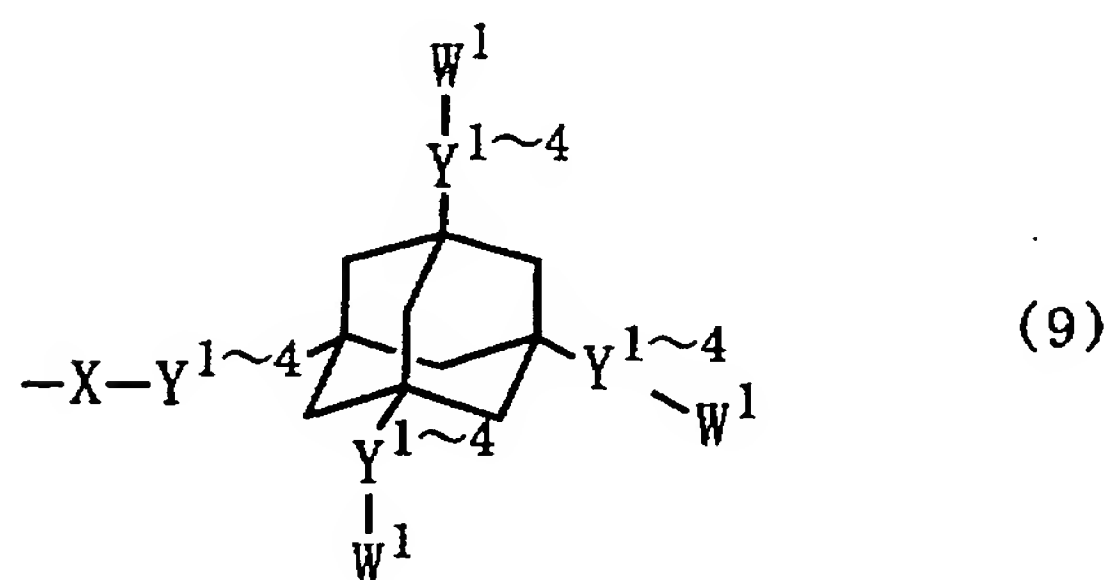
wherein Ring Z^1 represents a monocyclic or polycyclic aromatic or nonaromatic ring; and R^5 , R^6 , R^7 , and R^8 are substituents bound to Ring Z^1 , are the same as or different from one another, and each represent a protected or unprotected amino group, a protected or unprotected hydroxyl group, or a protected or unprotected mercapto group, wherein at least two of R^5 , R^6 , R^7 , and R^8 are each a protected or unprotected amino group, wherein the prepolymer is a compound represented by following Formula (7):



wherein Y¹, Y², Y³, and Y⁴ are as defined above; and W¹s each represent one of R¹, R², R³, R⁴, and a group represented by following Formula (8):



wherein Ring Z¹ is as defined above; R⁵⁻⁸ represents any one of R⁵, R⁶, R⁷, and R⁸; X is a bond formed as a result of a reaction between one of R¹ to R⁴ and one of R⁵ to R⁸ and represents an amide bond, an ester bond, or a thioester bond; and A¹ represents one of R⁵, R⁶, R⁷, R⁸, and a group represented by following Formula (9):

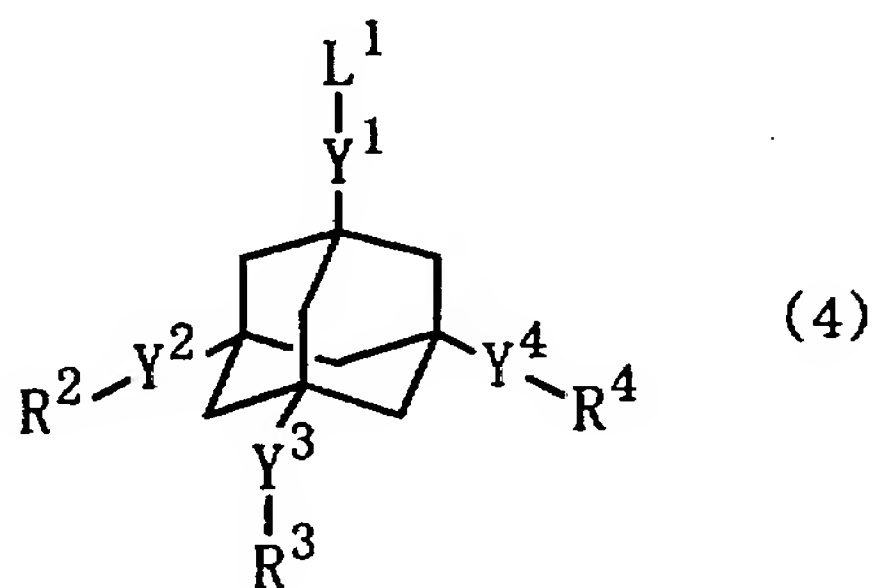


wherein W¹s and X are as defined above; and Y¹⁻⁴ represents

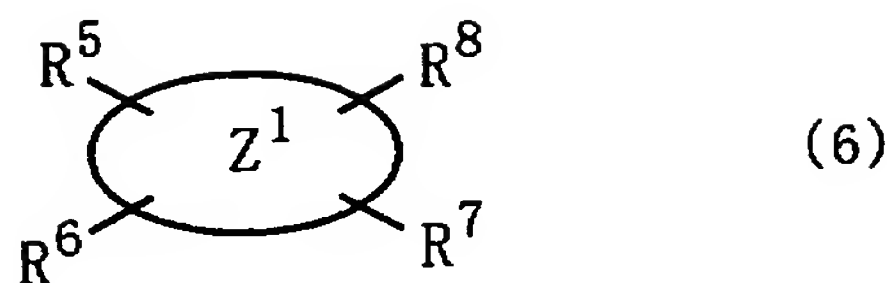
any one of Y^1 , Y^2 , Y^3 , and Y^4 ,

wherein at least one of the four W^1 s in Formula (7) is the group represented by Formula (8), and wherein A^1 s, W^1 s, and X s, if present plural in number, may be the same as or different from each other, respectively.

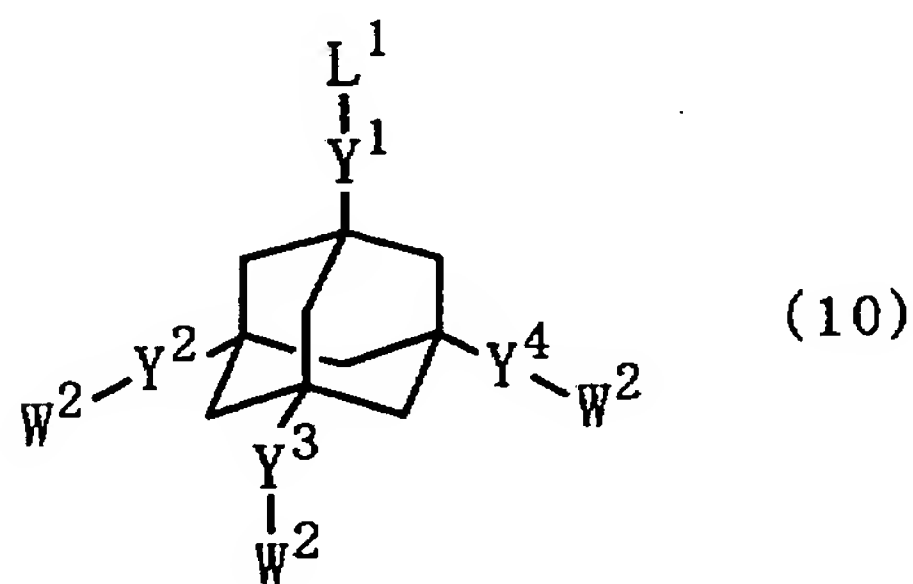
10. The prepolymer according to claim 8, as a reaction product between an adamantanepolycarboxylic acid derivative represented by following Formula (4):



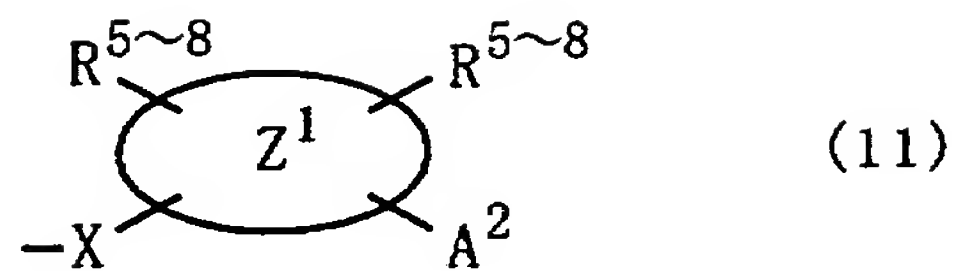
wherein L^1 represents a hydrogen atom, a protected or unprotected carboxyl group, or a hydrocarbon group; R^2 , R^3 , and R^4 are the same as or different from one another and each represent a protected or unprotected carboxyl group or a haloformyl group; and Y^1 , Y^2 , Y^3 , and Y^4 are the same as or different from one another and each represent a single bond or a bivalent aromatic or nonaromatic cyclic group, and a polyamine derivative represented by following Formula (6):



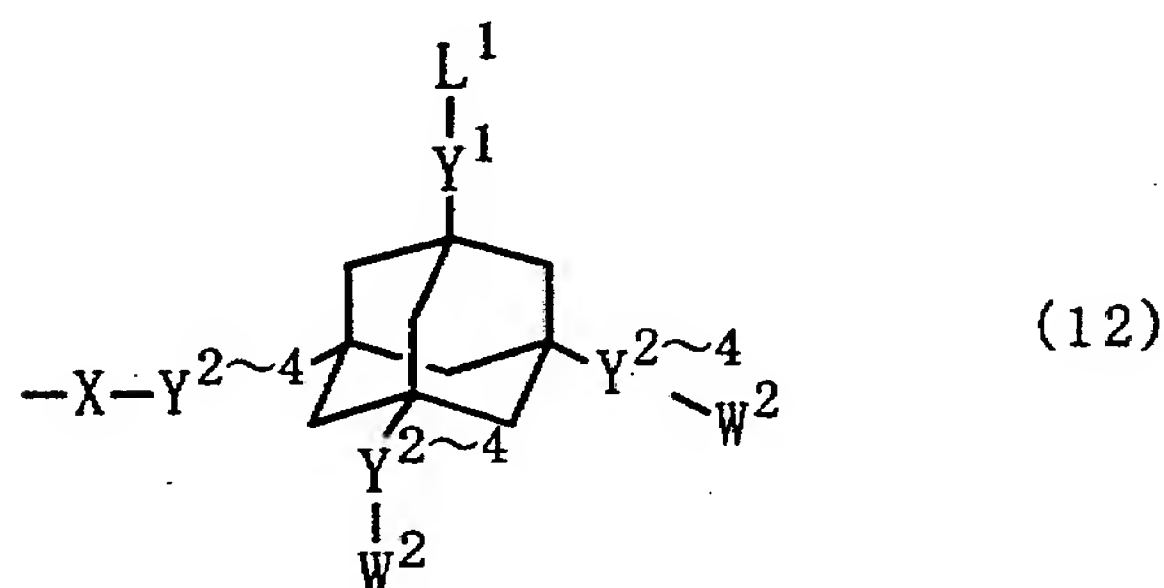
wherein Ring Z^1 represents a monocyclic or polycyclic aromatic or nonaromatic ring; and R^5 , R^6 , R^7 , and R^8 are substituents bound to Ring Z^1 , are the same as or different from one another, and each represent a protected or unprotected amino group, a protected or unprotected hydroxyl group, or a protected or unprotected mercapto group, wherein at least two of R^5 , R^6 , R^7 , and R^8 are each a protected or unprotected amino group, wherein the prepolymer is a compound represented by following Formula (10):



wherein L^1 , Y^1 , Y^2 , Y^3 , and Y^4 are as defined above; and W^2 s each represent one of R^2 , R^3 , R^4 , and a group represented by following Formula (11):

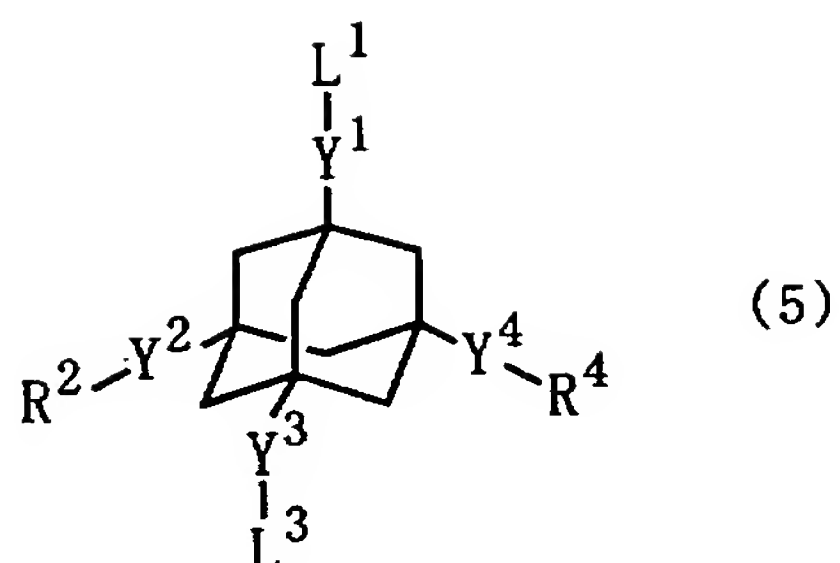


wherein Ring Z^1 is as defined above; R^{5-8} represents any one of R^5 , R^6 , R^7 , and R^8 ; X is a bond formed as a result of a reaction between one of R^2 to R^4 and one of R^5 to R^8 and represents an amide bond, an ester bond, or a thioester bond; and A^2 represents one of R^5 , R^6 , R^7 , R^8 , and a group represented by following Formula (12):

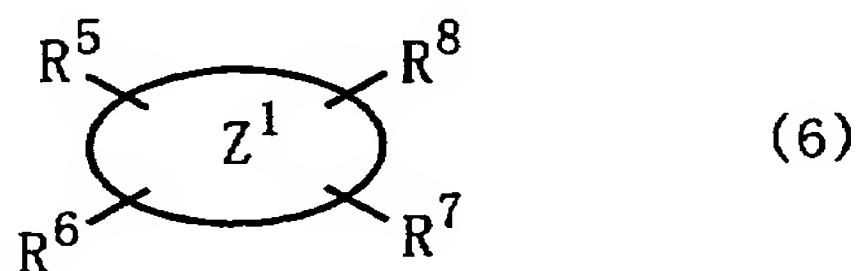


wherein L^1 , W^2 s, and X are as defined above; and Y^{2-4} represents any one of Y^2 , Y^3 , and Y^4 , wherein at least one of the three W^2 s in Formula (10) is the group represented by Formula (11), and wherein A^2 s, W^2 s, and X s, if present plural in number, may be the same as or different from each other, respectively.

11. The prepolymer according to claim 8, as a reaction product between an adamantanepolycarboxylic acid derivative represented by following Formula (5):

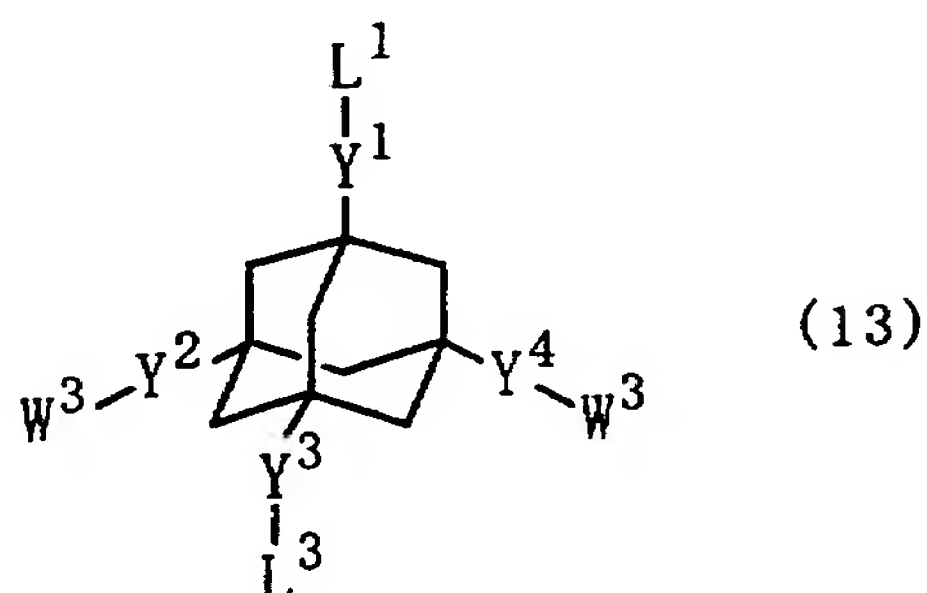


wherein L^1 and L^3 are the same as or different from each other and each represent a hydrogen atom, a protected or unprotected carboxyl group, or a hydrocarbon group; R^2 and R^4 are the same as or different from each other and each represent a protected or unprotected carboxyl group or a haloformyl group; and Y^1 , Y^2 , Y^3 , and Y^4 are the same as or different from one another and each represent a single bond or a bivalent aromatic or nonaromatic cyclic group, and a polyamine derivative represented by following Formula (6):

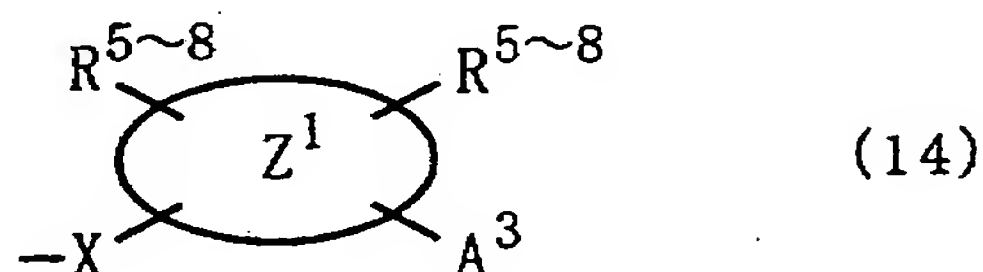


wherein Ring Z^1 represents a monocyclic or polycyclic aromatic or nonaromatic ring; and R^5 , R^6 , R^7 , and R^8 are substituents bound to Ring Z^1 , are the same as or different from one another, and each represent a protected or unprotected amino group, a protected or unprotected hydroxyl group, or a protected or unprotected mercapto group, wherein

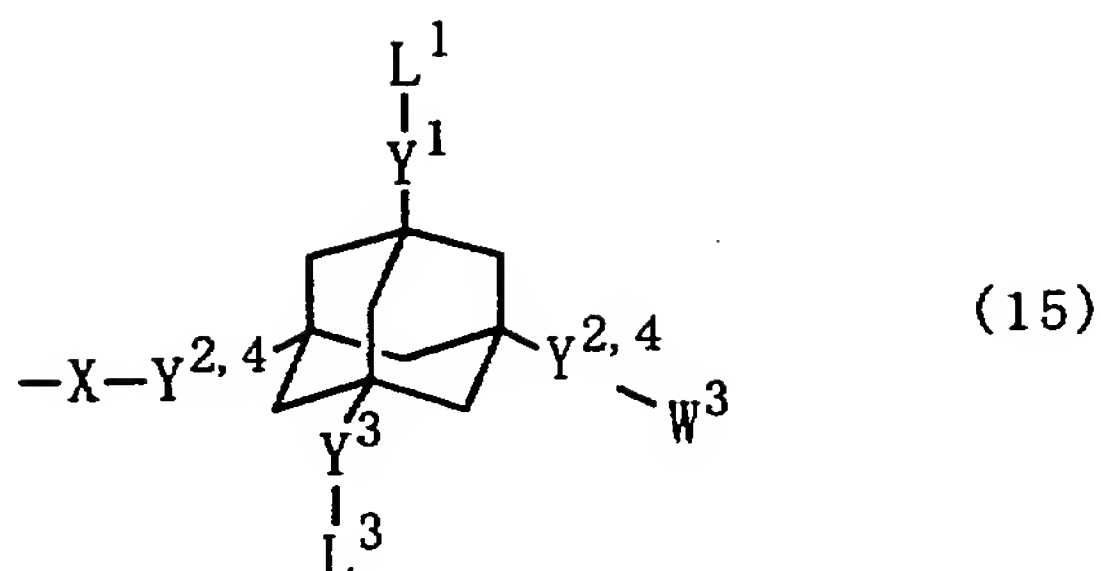
at least two of R^5 , R^6 , R^7 , and R^8 are each a protected or unprotected amino group,
wherein the prepolymer is a compound represented by following Formula (13):



wherein L^1 , L^3 , Y^1 , Y^2 , Y^3 , and Y^4 are as defined above; and W^3 s each represent one of R^2 , R^4 , and a group represented by following Formula (14):



wherein Ring Z^1 is as defined above; R^{5-8} represents any one of R^5 , R^6 , R^7 , and R^8 ; X is a bond formed as a result of a reaction between one of R^2 and R^4 , and one of R^5 to R^8 and represents an amide bond, an ester bond, or a thioester bond; and A^3 represents one of R^5 , R^6 , R^7 , R^8 , and a group represented by following Formula (15):



wherein L^1 , L^3 , W^3 , and X are as defined above; and $Y^{2,4}$ represents one of Y^2 and Y^4 , wherein at least one of the two W^3 s in Formula (13) is the group represented by Formula (14), and wherein A^3 s, W^3 s, and X s, if present plural in number, may be the same as or different from each other, respectively.

12. A prepolymer composition, as a solution of the prepolymer of any one of claims 1 to 11 in a solvent.

13. A high-molecular-weight polymer with a porous structure, as a reaction product of the prepolymer of any one of claims 1 to 11.

14. A dielectric film comprising the high-molecular-weight polymer with a porous structure of claim 13.

15. A method for producing a dielectric film, comprising the steps of applying a prepolymer composition to a base material, the prepolymer composition being a solution of the prepolymer of any one of claims 1 to 11 in a solvent; and subjecting the prepolymer composition on the base material to reaction to thereby yield a dielectric film comprising a

- 105 -

high-molecular-weight polymer with a porous structure.